PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 51568 WO	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/IB 2003/002900	International filing date *(day/month/year)* 22-07-2003	Priority date *(day/month/year)* ---
International Patent Classification (IPC) or national classification and IPC G06K 19/067		
Applicant Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 7 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))
      _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18-01-2005	16-06-2005
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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2003/002900

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-10,16,19-22 as originally filed/furnished
pages* 11-15,17-18 received by this Authority on 18-01-2005
pages* _____ received by this Authority on _____

☒ the claims:

pages 23-25 as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the drawings:

pages 1/2-2/2 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB 2003/002900

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-19	YES
	Claims		NO
Inventive step (IS)	Claims	1-19	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-19	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1: US 2002106988 A1
D2: EP 926623 A1
D3: DE 10042805 A1
D4: US 2003030542 A1
D5: US 6462647 B1

The cited documents represent the general state of the art.

The invention defined in claims 1-19 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed reader device for radio frequency identification transponders, portable electronic device or system including a portable electronic device and a reader device for radio frequency identification transponders. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-19 is novel and is considered to involve an inventive step. The invention is industrially applicable.

power supply signal and clock signal are supplied from the RF interface 150 to the RFID tag unit 200 via the switch 100 and may be part of the signals transmitted via the signal connections 30 and signal connections 50.

Depending on the switching state or position of the switch 100, either the RFID tag reader unit 300 is coupled to the RF interface 150 or the RFID tag unit 200 is coupled to the RF interface 150. In the former case RFID tag reader functionality is available whereas in the latter case RFID tag functionality is available.

The RFID tag reader device 600 and hence the RFID tag reader unit 300 is provided with an interface indicated by communication connections 10 to allow an application 400, which is operated on a portable terminal comparable to portable terminals 1 or 2, communicating with the RFID tag reader device 600 and in particular with the RFID tag reader unit 300, respectively. The interface interfacing between RFID tag reader device 600 and application is established by appropriate hardware and software interfaces that allow access of the application 400 to the RFID tag reader device 600.

Referring back to near field communication standard (ECMA-340), the purposed RFID tag reader functionality and the RFID tag functionality as described above in view of an embodiment illustrated by functional units depicted in Fig. 2 enables to establish a further communication mode additional to the standardized passive and active communication mode.

As described in detail above, the field communication standard (ECMA-340) addresses the operation of RFID tag reader devices and provides the active communication mode, which is used preferably in communication with one or more RFID tags. Additionally, the field communication standard (ECMA-340) provides the passive communication mode, which is intended for communication with another RFID tag reader device. Both the active and passive communication modes require necessarily energizing of the communicating RFID tag reader device via a power supply. In case of the active communication mode the necessity of a power supply is obvious since communication with one or more passive RFID tags requires energizing of the passive RFID tags via one or more interrogating signals of the communicating RFID tag reader device.

Additionally, the active as well as passive communication modes allow operating reading functionality and writing functionality of the RFID tag reader device. That means, the RFID tag reader device having reading functionality is adapted to retrieve information stored in one or more RFID tags. The reading functionality is at least the basic functionality of a RFID tag reader

device. The RFID tag reader device having writing functionality is adapted to add information to RFID tags to be stored and/or modify information stored in RFID tags. It shall be noted that the adding and/or modifying of information stored in RFID tags depends on the capability of the RFID tags and/or authorization of the RFID tag reader device. The writing functionality is an enhanced functionality of a RFID tag reader device.

The RFID tag functionality as described above in detail in view of an embodiment illustrated by functional units depicted in Fig. 2 may be employed to establish a new communication mode, which will be denoted as show communication mode. In the show communication mode the RFID tag functionality is switched while the RFID tag reader functionality is out of operation. The show communication mode is distinguished from the known communication modes therein that the RFID tag functionality provides the physical advantages of a passive RFID tag, which does not require any internal power supply. This is in clear contrast to the passive communication mode, which may be regarded as functionality, which simulates a RFID tag. This essential advantage will become more intellectual in view of the usage cases, which are presented below. Further, advantages addressing the implementation of the RFID tag functionality will become apparent in view of RFID tag reader devices according to embodiments of the present invention.

The information stored in the RFID tag unit 200 that can be retrieved by a RFID tag reader device 600 as illustrated above is stored in an adequate storage component. The storage component may be a read-only storage component or a configurable storage component. In case of a configurable storage component a number of storage technologies are applicable and in particular non-volatile configurable storage technologies are of interest.

In analogy to Fig. 1 it shall be assumed that the RFID tag reader device 600 as embodied in Fig. 2 is attached to or embedded in a portable terminal 1 such as portable terminals 1 and 2 depicted in Fig. 1. Conventionally, the RFID tag reader device 600 may be provided with an interface such as a serial interface interfacing data exchanged between the RFID tag reader device 600 and the portable terminal 1 such that applications executed on the portable terminal 1 can use the functionality, which is provided by the RFID tag reader device 600. An application program interface (API) layer may support the communication between applications such as applications 400 and 410 and the RFID tag reader device 600.

Whereas the operation of a RFID tag reader device 600 according to the embodiment has been described by the means of functional units the following Fig. 3a and Fig. 3b illustrate more detailed embodied RFID tag reader device.

Fig. 3a depicts a block diagram, which illustrates an embodiment of a RFID tag reader device according to the present invention.

The tag reader device 600 comprises a reader logic 310, an optional reader memory 320, a RF interface 150 and an antenna 160. These components establish a complete conventional tag reader device. With respect to the present invention, the illustrated tag reader device 600 comprises further a matrix switch 100, a tag logic 210 and a tag memory 250. The tag reader device 600 is coupled to the terminal _1_ via an appropriate interface such that _the application 400 can communicate with the tag reader device 600. The illustrate tag reader device 600 corresponds in its design to the arrangement of the functional units explained with reference to Fig. 2.

The antenna 160 and the RF interface 150 are common units used for RFID tag reader operation and for RFID tag operation. The matrix switch 110 is controlled via the switch line 110, which is herein supplied with switching signal by the terminal 1. Alternatively, without leaving the scope of the invention, the switching state of the switch 100 may by also controlled by the RFID tag reader device 600 itself, which may ensure a higher readability. In show communication mode, as defined above, the antenna 160 and the RF interface 150 are coupled via the switch 100 to the tag logic 210, whereas in all other communication modes the antenna 160 and the RF interface 150 are coupled via the switch 100 to the reader logic 310. Since the RFID tag functionality corresponds in its externally visible physical properties to a passive RFID tag, the RF interface may provide additionally at least a power supply signal and a clock signal to the tag logic 210 via the switch 100 (shown) or directly unswitched (not shown).

In show communication mode, i.e. when operating RFID tag functionality, the RF interface 150 forms the interface between the analogue, radio frequency transmission channel from a requesting RFID tag reader device to the RFID tag and the tag logic 210 of the RFID tag. The modulated RF (HF) signal from the requesting RFID tag reader device is reconstructed in the RF interface 150 by demodulation to create a digital serial data stream for reprocessing in the tag logic. The tag logic 210 is preferably embodied as a digital logic serving as address and/or security logic. A clock-pulse generation circuit in the RF interface 150 generates the system clock for the data carrier from the carrier frequency of the RF (HF) field supplied by the requesting RFID tag reader device. The RF interface 150 may further incorporate a load modulator or backscatter modulator (or any alternative procedure, e.g. frequency divider), controlled by the digital data being transmitted, to return data to the requesting RFID tag reader

device. Moreover the RF interface 150 draws current from the antenna 160 which is rectified and supplied to the tag logic 210 as a regulated supply voltage.

The tag logic 210 may support a passive read-only RFID tag implementation and a re-writeable RFID tag implementation. As soon as a passive read only RFID tag enters the interrogation zone of a RFID tag reader device it begins to continuously transmit information stored in the tag memory 250 associated with tag logic 210. In principle, the tag memory 250 illustrated as a separate component may be included in the tag logic 210. The stored information may comprise a tag identification number, which relates to the original purpose of the RFID tags. But the stored information is not limited thereto. Depending of the realization and complexity of the tag logic 210, also sophisticated operations on stored information is possible wherein the operations can be instructed by commands additionally transmitted in the interrogation zone, e.g. modulated on the interrogating signal. Typically, the communication between passive read-only RFID tags and the RFID tag reader devices is unidirectional, with the RFID tag sending its stored information to the RFID tag reader device continuously. But data transmission from the RFID tag reader device to the RFID tag is possible. A re-writeable RFID tag implementation that can be written with data by the RFID tag reader device can be realized with varying memory capacities which only depends in the implementation of the tag memory 250. Typically write and read access to the re-writeable RFID tag is often in blocks, which are formed by assembling a predefined number of bytes, which can then be read or written.

The tag logic 210 may be realized in a simple implementation as a state machine.

In active and/or passive communication modes, i.e. when operating RFID tag reader functionality, the RF interface 150 forms a transmitter and receiver.

The RF interface 150 should perform the following functions when operated in conjunction with RFID tag reader functionality. The RF interface 150 is adapted to generate radio/high (RF/HF) frequency transmission power serving as interrogating signal to activate RFID tags and supply RFID tags with power. Further, the RF interface 150 is adapted to modulate transmission signals on the carrier frequency to transmit data and/or instructions to the interrogated RFID tags and to receive and demodulate response signals transmitted back by the interrogated RFID tags.

The reader logic 310 may be realized as an application specific integrated circuit (ASIC) module, a microcontroller (μC), a microprocessor (μP) and the like. In order to allow communication with the terminal 1, in which the RFID tag reader device 600 is embedded or to which the RFID tag reader device 600 is attached, the reader logic 310 also provides an data communication interface

such as a serial interface (e.g. a RS232 interface) to perform the data exchange between the RFID tag reader device 600 (slave) and the external application 400 (master) executed on the terminal 1.

The reader logic 310 may also be associated with an optional reader memory 320. Conventionally, a distinct reader memory 320 is not necessary for RFID tag reader functionality, but the reader memory 320 may be used as a buffer storage for communication with the terminal 1 as well as with a RFID tag or another RFID tag reader device.

In view of the present invention, the tag memory 250 may be configurable; i.e. information stored in the tag memory may be modified, added, processed and/or deleted. According to an embodiment of the invention, the configuration of the information stored in the configurable tag memory 250 may be limited to the terminal 1 and applications executed thereon. Moreover, the access to the configurable tag memory 250 may be limited to one or more specific applications executed on the terminal 1 to ensure data integrity, which may be required and necessary, respectively, depending on the kind of information stored.

The access to the tag memory 250 to configure information stored therein may be established via a dedicated interface (not shown) connecting the terminal 1 and one or more applications, respectively, executed thereon to the memory tag 250. Alternatively, the access to the tag memory 250 to configure information stored therein may be established (mediated) via the reader logic 310 and the microprocessor (μP) / microcontroller (μC), respectively, which is provided with an interface interfacing data communication between RFID tag reader device 600 and terminal 1 and one or more applications executed thereon, respectively.

In case the configuration of the information stored in the tag memory 250 is limited to e.g. a specific application executed on the terminal 1 the externally visible RFID tag property is comparable to a read-only RFID tag. That means, another communicating RFID tag reader device recognizes the RFID tag reader device 600 as a read-only RFID tag when the RFID tag reader device 600 is switched to RFID tag functionality. In particularly, the other communicating RFID tag reader device recognizes the RFID tag reader device 600 as a passive read-only RFID tag when the RFID tag reader device 600 is switched to RFID tag functionality.

The configurable tag memory 250 may be understood as dynamic tag memory 250, which on the one side shows read-only properties to other communicating RFID tag reader devices, whereas the information stored in the tag memory 250 is modifiable under circumstances enlightened above. In principle, the storage capacity of the tag memory 250 is not limited such that the

interface to the terminal 1 and the application 400 executed thereon, respectively, and which operates the interface and protocol framework for communicating with RFID tags (passive communication mode) and in particular, when supporting active communication mode, for communicating with RFID tag reader devices. An optional reader memory 320 is associated with the microcontroller (μC) 310 and a microprocessor (μP) 310, respectively.

A switch / logic component 610 is interposed between RF interface 150 and reader logic 310 to switch between RFID tag reader functionality and RFID tag functionality as described in detail above. The switch / logic component 610 implement tag logic necessary for providing RFID tag functionality. Correspondingly, the tag memory 250 is connected to the switch / logic component 610.

The common RF interface 150 provides signals to the switch / logic component 610, which are required for operation of RFID tag reader functionality and RFID tag functionality, wherein in this embodiment the switch / logic component 610 passes through signals to the microprocessor (μP) 310, which are required by the microprocessor (μP) 310. The passing through of the signals depend on the switching state of the switch / logic component 610. Alternatively, the switch / logic component 610 and the microprocessor (μP) 310 may be implemented in a common logic component (not shown), which is adapted to operate functions of the switch / logic component 610 as well as functions of the microprocessor (μP) 310.

As aforementioned, the switching state of the switch / logic component 610 and the switch 100 defines the functionality of the RFID tag reader device 600, respectively. The switching state and therefore the switching operation is important to ensure proper operation of the RFID tag reader device 600 as enlightened. According to an embodiment, the switching state of the switch / logic component 610 and the switch 100 is controlled by a switching signal supplied thereto via the switch line 110. The switching signal is generated by the terminal 1, to which the RFID tag reader device 600 is connected. The controlling of the switching state by an specific application executed on the terminal 1 may be critical and less reliable, respectively, since in case of a sudden or unexpected loss of power of the terminal 1 the switching state is undefined or the switching state remains in its former switching state such that RFID tag functionality may not be switched. This situation may be unsatisfactory.

In a more reliable embodiment of the RFID tag reader device 600 according to the present invention, the selecting of the switching state may be semi-autonomously or autonomously (corresponding to a semi-autonomous operation mode and a autonomous operation mode, respectively). Semi-autonomous operation mode means that for example in case of a sudden or

unexpected power loss or always when the RFID tag reader device 600 is out of power supply the RFID tag functionality is selected and the switching state is correspondingly adapted thereto. Analogously, the RFID tag reader device 600 may be operable with RFID tag reader functionality in case the terminal 1 and one or more applications executed thereon, respectively, instruct to select / switch to RFID tag reader functionality. So if no explicit indication to select RFID tag reader functionality is present the RFID tag reader device 600 is operated in RFID tag functionality by default.

In autonomous operation mode the switch, i.e. the switch 100 and the switch / logic component 610, respectively, comprise a switching logic which autonomously selects and switches between the RFID tag functionality and the RFID tag reader functionality.

It shall be noted, that the RFID tag reader functionality may support passive communication mode and active communication mode in accordance with near field communication standard (ECMA-340) and the RFID tag functionality may support show communication functionality which has been defined above and described in detail.

Use Cases

In the following an overview of example usage cases shall be given in view of which the advantages of the present invention will become clearly apparent.

(a) Access key

A typical range of application of RFID tags is access control to areas of controlled / surveyed / limited access and the use of RFID tags for substituting conventional keys. A RFID tag may be used to open a door, to start a vehicle, to get access to a computer and the like. Such RFID tags are for example embedded in keys of state of the art motor vehicles to prevent burglary or replace the key to open the door to the office. For access control, a RFID tag reader device of an access control system retrieves information from a RFID tag, which is conventionally a passive read-only RFID tag. The information is checked by the access control system to decide whether access is to be granted or not.

In case a RFID tag reader device which supports passive communication mode such as enlighten above is used for such an application the requirement of power supply for operating the RFID tag reader device in passive communication mode is a serious